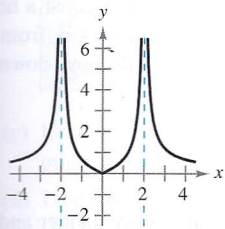


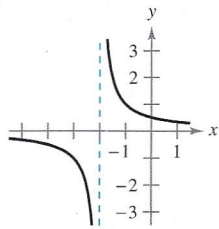
## EXERCISES FOR SECTION 1.5

In Exercises 1–4, determine whether  $f(x)$  approaches  $\infty$  or  $-\infty$  as  $x$  approaches  $-2$  from the left and from the right.

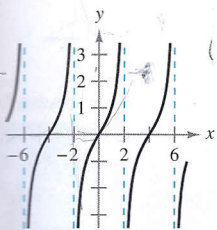
1.  $f(x) = 2\left|\frac{x}{x^2 - 4}\right|$



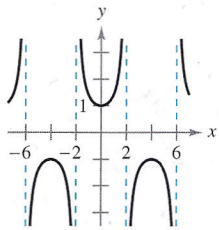
2.  $f(x) = \frac{1}{x + 2}$



3.  $f(x) = \tan \frac{\pi x}{4}$



4.  $f(x) = \sec \frac{\pi x}{4}$



17.  $f(x) = \tan 2x$

18.  $f(x) = \sec \pi x$

19.  $T(t) = 1 - \frac{4}{t^2}$

20.  $g(x) = \frac{\frac{1}{2}x^3 - x^2 - 4x}{3x^2 - 6x - 24}$

21.  $f(x) = \frac{x}{x^2 + x - 2}$

22.  $f(x) = \frac{4x^2 + 4x - 24}{x^4 - 2x^3 - 9x^2 + 18x}$

23.  $g(x) = \frac{x^3 + 1}{x + 1}$

24.  $h(x) = \frac{x^2 - 4}{x^3 + 2x^2 + x + 2}$

25.  $f(x) = \frac{x^2 - 2x - 15}{x^3 - 5x^2 + x - 5}$

26.  $h(t) = \frac{t^2 - 2t}{t^4 - 16}$

27.  $s(t) = \frac{t}{\sin t}$

28.  $g(\theta) = \frac{\tan \theta}{\theta}$

In Exercises 29–32, determine whether the function has a vertical asymptote or a removable discontinuity at  $x = -1$ . Graph the function using a graphing utility to confirm your answer.

29.  $f(x) = \frac{x^2 - 1}{x + 1}$

30.  $f(x) = \frac{x^2 - 6x - 7}{x + 1}$

31.  $f(x) = \frac{x^2 + 1}{x + 1}$

32.  $f(x) = \frac{\sin(x + 1)}{x + 1}$

In Exercises 33–48, find the limit.

33.  $\lim_{x \rightarrow 2^+} \frac{x - 3}{x - 2}$

34.  $\lim_{x \rightarrow 1^+} \frac{2 + x}{1 - x}$

35.  $\lim_{x \rightarrow 3^+} \frac{x^2}{x^2 - 9}$

36.  $\lim_{x \rightarrow 4^-} \frac{x^2}{x^2 + 16}$

37.  $\lim_{x \rightarrow -3^-} \frac{x^2 + 2x - 3}{x^2 + x - 6}$

38.  $\lim_{x \rightarrow (-1/2)^+} \frac{6x^2 + x - 1}{4x^2 - 4x - 3}$

39.  $\lim_{x \rightarrow 1} \frac{x^2 - x}{(x^2 + 1)(x - 1)}$

40.  $\lim_{x \rightarrow 3} \frac{x - 2}{x^2}$

41.  $\lim_{x \rightarrow 0^-} \left(1 + \frac{1}{x}\right)$

42.  $\lim_{x \rightarrow 0^-} \left(x^2 - \frac{1}{x}\right)$

43.  $\lim_{x \rightarrow 0^+} \frac{2}{\sin x}$

44.  $\lim_{x \rightarrow (\pi/2)^+} \frac{-2}{\cos x}$

45.  $\lim_{x \rightarrow \pi} \frac{\sqrt{x}}{\csc x}$

46.  $\lim_{x \rightarrow 0} \frac{x + 2}{\cot x}$

47.  $\lim_{x \rightarrow 1/2} x \sec \pi x$

48.  $\lim_{x \rightarrow 1/2} x^2 \tan \pi x$

Numerical and Graphical Analysis In Exercises 5–8, determine whether  $f(x)$  approaches  $\infty$  or  $-\infty$  as  $x$  approaches  $-3$  from the left and from the right by completing the table. Use a graphing utility to graph the function and confirm your answer.

| $x$    | -3.5 | -3.1 | -3.01 | -3.001 |
|--------|------|------|-------|--------|
| $f(x)$ |      |      |       |        |

| $x$    | -2.999 | -2.99 | -2.9 | -2.5 |
|--------|--------|-------|------|------|
| $f(x)$ |        |       |      |      |

5.  $f(x) = \frac{1}{x^2 - 9}$

6.  $f(x) = \frac{x}{x^2 - 9}$

7.  $f(x) = \frac{x^2}{x^2 - 9}$

8.  $f(x) = \sec \frac{\pi x}{6}$

In Exercises 9–28, find the vertical asymptotes (if any) of the function.

9.  $f(x) = \frac{1}{x^2}$

10.  $f(x) = \frac{4}{(x - 2)^3}$

11.  $h(x) = \frac{x^2 - 2}{x^2 - x - 2}$

12.  $g(x) = \frac{2 + x}{x^2(1 - x)}$

13.  $f(x) = \frac{x^2}{x^2 - 4}$

14.  $f(x) = \frac{-4x}{x^2 + 4}$

15.  $g(t) = \frac{t - 1}{t^2 + 1}$

16.  $h(s) = \frac{2s - 3}{s^2 - 25}$

In Exercises 49–52, use a graphing utility to graph the function and determine the one-sided limit.

49.  $f(x) = \frac{x^2 + x + 1}{x^3 - 1}$

50.  $f(x) = \frac{x^3 - 1}{x^2 + x + 1}$

$\lim_{x \rightarrow 1^+} f(x)$

$\lim_{x \rightarrow 1^-} f(x)$

51.  $f(x) = \frac{1}{x^2 - 25}$

$\lim_{x \rightarrow 5^-} f(x)$

52.  $f(x) = \sec \frac{\pi x}{6}$

$\lim_{x \rightarrow 3^+} f(x)$